Section 3. Plan Formulation

Measures for addressing the flood control problems and needs related to Bayou Sorrel Lock were limited to structural measures to prevent the overtopping of the lock during a project flood in the Atchafalaya Basin Floodway. The only non-structural plan considered was flood fighting. Flood control problems and needs for Bayou Sorrel Lock are being addressed under the authority of the Flood Control, Mississippi River and Tributaries project, which provides for the confining of the project flood within the Atchafalaya Basin Floodway system. Measures for addressing navigation problems and needs at Bayou Sorrel Lock were limited to structural measures to increase the capacity of Bayou Sorrel Lock, small-scale improvements at other locks in the Gulf Intracoastal Waterway (GIWW) system, and improvements on other inland navigation routes. Navigation problems and needs are being addressed under Congressional resolutions authorizing the review of the GIWW with a view of modifying the existing project.

1. Plan Formulation Rationale and Constraints

a. Plan Formulation Rationale.

- The modification of Bayou Sorrel Lock to safely pass the Atchafalaya Basin Floodway project flood is an authorized feature of the Atchafalaya Basin, Louisiana project. The first phase of the plan formulation is to develop the best plan, from an overall standpoint, to pass the project flood. The plan selected for passing the project flood will be the base plan, or the "without project" conditions for the incremental analysis of the feasibility of alternative plans to increase the capacity of Bayou Sorrel Lock and alternative inland navigation routes.

- The lock is stable for its original design loading conditions and is in good operating condition, however, it was not designed to withstand the higher stages on the floodway-side of the lock. Modification of the existing lock to the current design elevation is not feasible, from an engineering standpoint. Poor soil conditions make it impossible for the structure to handle the additional loads associated with the higher design water levels in floodway.

- The modification of Bayou Sorrel Lock to safely pass the Atchafalaya Basin Floodway project flood is an inseparable feature of the Flood Control, Mississippi River and Tributaries project. The cost of the modification is included in the total cost of the overall project for controlling floods on the Mississippi River below Cairo, Illinois, and the benefits for the modification are the total benefits for the project. It is not a separable feature of the overall project that will be evaluated to determine whether it should be included in the project, based on its incremental costs and benefits.

- Plans to increase the capacity of Bayou Sorrel Lock are based on a "systems analysis" of the inland waterway system pertinent to Bayou Sorrel Lock. In the systems analysis, the capacities of other locks and waterways in the inland navigation system are modeled to determine the optimum plan for inland navigation at Bayou Sorrel Lock; however, alternative locks sizes at other locks are not considered. Alternative capacities for other locks in the inland waterway system were not evaluated in the study.

- Only 1,200-foot chamber lengths are being considered for larger replacement locks plans at Bayou Sorrel Lock. The 1,200-foot length was approved by CECW-PC memo, subject: Reducing the Time and Cost for Planning Studies, dated 8 August 1996 (See Exhibit 4). The 1,200-foot length has become standard on the GIWW system. Port Allen Lock, which is the next lock on Morgan City-to-Port Allen Alternate Route north of Bayou Sorrel Lock, and Leland Bowman and Bayou Boeuf Locks, the next locks in the system south of Bayou Sorrel Lock, have 1,200-foot chamber lengths.

b. Plan Formulation Constraints.

- Planning activities are constrained by laws, policies, and regulations governing the planning and development of Federal water resources development projects. Principles and Guidelines directives stipulate that the recommended plan must have incremental system benefits (transportation savings) in excess of incremental system cost, and that the recommended plan provides the maximum net economic benefits to the nation (NED Plan).

- Due to changes in the project flood flowline since the lock was constructed, the lock structure is 8 feet lower than the design elevation for the EABPL and 5 feet lower than the project flood flowline. Modification of the existing lock to the current design elevation is not feasible, from an engineering standpoint. Poor soil conditions make it impossible for the structure to handle the additional loads associated with the higher design water levels in floodway.

- Alternative locations for a new lock were considered in the preliminary formulation of alternative plans to try to eliminate bank erosion, noise, bridge openings, and bridge damage caused by vessel traffic in the Bayou Sorrel community. There are no practicable alternative locations for a replacement lock at Bayou Sorrel, and these plans were eliminated from further consideration.

- Relocating the lock South of the existing lock would relocate the navigation corridor along the east side of the existing lock. This alignment would pose navigation problems where the new channel would intersect the Lower Grand River. Also, for this alignment, long connecting channels would have to be dredged through bottomland hardwood forest and cypress swamp, thus producing significant adverse impacts and requiring substantial mitigation. State Highway

75 would also likely have to be realigned. For these reasons, this alignment was eliminated from further study.

- The Bayou Sorrel community lies about one and one-half miles north of the Bayou Sorrel lock. For socioeconomic reasons, no alignment that would directly affect the community of Bayou Sorrel was considered. Farther north lies extensive areas of bottomland hardwood forest and cypress swamp. Some local residents have suggested that the new lock be built north of Bayou Sorrel so that the re-aligned navigation channel would bypass the Bayou Sorrel bridge. Upon evaluation of potential alignments north of Bayou Sorrel, it was quickly noted that the East Access Channel and the GIWW diverge at 90-degree angles, making any navigation alignment between these waterways problematic. Any alignment to the north of Bayou Sorrel would require dredging miles of new channel through bottomland hardwood forest and cypress swamp, causing significant adverse impacts to the environment of the area.

- An important principle in environmental planning is to restrict new development to existing developed corridors and avoid impacting undisturbed areas. There is an existing navigation corridor at Bayou Sorrel and a new lock can be built within this existing developed and disturbed corridor owned by the Government. It is acknowledged that the vessel traffic on the GIWW adversely affects the residents of the Bayou Sorrel community through bank erosion, noise, bridge openings, and bridge damage.

- The Port Allen-to-Morgan City Alternate Route is a heavily used waterway with inland barge traffic projected to increase under future conditions, without a new lock at Bayou Sorrel. Delays to navigation caused by short-term closure of this waterway is estimated to cost the navigation industry $800,000 per day while long-term closure is estimated at $534,000 per day. In the formulation of plans for the modification of Bayou Sorrel Lock, closures should be avoided or minimized, as the cost of a long-term closure could affect the viability of a plan and would result in strong opposition from the navigation industry.

2. Alternative Measures Considered

a. **General**. Plans formulated for the Bayou Sorrel Lock, Louisiana feasibility study were based on proven concepts, historical data and the designs prepared for the reconnaissance report. Rudimentary design was performed to establish the nominal dimensions of major lock components and high cost items. Potential alternatives have been screened based on experience and knowledge of the study team in this type of study. In this interim feasibility study, plan formulation focused on two integral components affecting Bayou Sorrel Lock: flood control and lockage delays.

b. **Flood Control Plans**. Three plans were considered for passing the Atchafalaya Basin project flood in the vicinity of Bayou Sorrel Lock; (1) an independent float-in floodgate located on the floodside of the lock, (2) a replacement-in-kind lock, that is, a lock with the same chamber dimensions as the existing Bayou Sorrel Lock, and (3) flood fighting. The flood control plans would provide for measures to pass the FC,MR&T project flood at Bayou Sorrel, and for navigation through the lock with no changes in delays, relative to existing conditions and future conditions projected to occur with the existing Bayou Sorrel Lock.

(1) **Independent Float-In Flood Gate Plan.** This plan provides for the construction of a navigable sector gate in the Atchafalaya Basin Floodway on the flood side of the existing Bayou Sorrel Lock. The gate would have a width of 56 feet, a floor elevation of –15 feet NGVD, and top of walls elevation of 31.7 feet NGVD. The structure would be constructed at an adjacent graving site surrounded by an earthen cofferdam, to provide flood protection during construction. Upon completion, the cofferdam would be breached to allow the structure to be floated out and positioned above its foundation. Once lowered into place, the pile foundation would be grouted to the structure's concrete base. To complete the line of flood protection, approximately 240 linear feet of pile-supported reinforced concrete T-wall and I-wall would be constructed to tie into the existing East Atchafalaya Basin protection levees.

The float-in construction technique was chosen to minimize closure of the Morgan City-to-Port Allen route to navigation. The structure would be a pile-founded, post-tensioned and reinforced concrete sector gate monolith. Bayou Sorrel Lock would be closed to navigation for a period of 60 days, while the piles are driven for the foundation and the structure is floated into place. In addition, it would be closed to navigation for 8 hours per day for a period of an additional 490 days while work on the structure is completed.

The floodgate would be closed when stages at Bayou Sorrel Lock approach the project design elevation of 31.7 NGVD. The Morgan City-to-Port Allen alternate route of the GIWW would be closed to navigation at that time due to strong river currents and the associated hazards to navigation on the Lower Atchafalaya River in the Morgan City, Louisiana area.

There are no relocations of residential or commercial structures, bridges, or utilities required for this plan.

All work would be constructed on Government-owned property and on adjacent lands upon which the government has perpetual maintenance dredging disposal easements and channel easements. It is presently dominated by young black willow, sycamore, and scrub/shrub woodlands.

The estimated implementation cost for the independent float-in floodgate plan is presented in Table 3-1.

Table 3-1
Estimated Implementation Cost
for the
Independent Float-In Floodgate Plan
(2000 Price Levels)

Construction	**$25,443,000**
Engineering and Design	**2,200,000**
Supervision and Inspection	**1,500,000**
SUBTOTAL	**$29,143,000**
Mitigation	**-0-**
Relocations	**-0-**
Real Estate	**-0-**
Closure Cost to Navigation	**$32,040,000**
TOTAL IMPLEMENTATON COST	**$61,183,000**

The sole purpose of the Independent Float-In Floodgate Plan is to pass the FC,MR&T project flood in the Atchafalaya Basin at Bayou Sorrel. All costs for the implementation and operation and maintenance of the independent float-in floodgate plan would be allocated to the Flood Control, Mississippi River and Tributaries project and would be borne 100 percent by the Federal government.

(2) **Replacement-In-Kind Lock.** This plan provides for the construction of a new lock immediately adjacent to and west of the existing Bayou Sorrel Lock. The new lock would have the same chamber dimensions of the existing lock, 56 feet wide by 797 feet long, with a sill elevation of –15 feet NGVD.

There are no relocations of bridges or utilities required for this plan.

The replacement-in-kind lock will be built on existing fee-owned land (262 acres). The construction of this project will require 273.2 acres of new fee-owned land and 102.4 acres of easement. One landowner owns all new right-of-way. All of the land that will be required in fee is already encumbered with Corps of Engineers easements for the Gulf Intracoastal Waterway-Alternate Route or the East Access Channel, or with a levee easement held by the Atchafalaya Basin Levee District.

With this plan, there are five structures that would be removed from lands over which the Government has easements. These structures, consisting of mobile homes and small wood frame houses, are located on land over which the United States holds a perpetual channel easement for the GIWW. The owners of these structures are not entitled to compensation and benefit payment under the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law-91-646).

Lock and channel construction and dredged material disposal would directly affect 240.4 acres of land. Of the 240.4 acres, 143.7 acres exist as dredged material disposal areas that are in various stages of regeneration. About 45.1 acres are considered disturbed bottomland hardwood forest. The remaining 51.6 acres is disturbed bottomland hardwood forest on Government owned property. With a new lock in place dredged material from maintenance dredging would be placed in the old lock chamber and the old connecting channels for about 35 years after completion of the project.

There would be no effects on navigation with a replacement lock during the construction period. The estimated implementation cost for the replacement lock plan is presented in Table 3-2.

Table 3-2
Estimated Implementation Cost
for the
Replacement-in-Kind Lock[1]
(2000 Price Levels)

Construction	**$63,500,000**
Engineering and Design	**6,350,000**
Supervision and Inspection	**4,445,000**
SUBTOTAL	**$74,295,000**
Mitigation	**$504,000**
Relocations	**-0-**
Real Estate	**54,000**
TOTAL IMPLEMENTATON COST	**$75,339,000**

[1]A lock with the same dimensions as the existing lock, 56 feet wide by 797 feet long.

The sole purpose of the Replacement-in-Kind Lock Plan is to pass the FC,MR&T project flood in the Atchafalaya Basin at Bayou Sorrel. All costs for the implementation and operation and maintenance of the replacement-in-kind lock plan would be allocated to the Flood Control, Mississippi River and Tributaries project and would be borne 100 percent by the Federal government.

(3) **Flood Fighting.** Flood fighting at Bayou Sorrel Lock would provide for the implementation of temporary measures during a major flood to prevent overtopping of the lock walls. Temporary measures would include sand-bagging and/or filling the chamber with fill material. A structural stability study of the existing south gatebay structure,

completed in 1980, indicated that it would be overstressed for an upper pool of El. 23.5 (NGVD) and a lower pool of El. 4.00 (NGVD). If no action were taken to replace the Bayou Sorrel Lock, emergency actions, such as sandbagging and piling-up fill material on the existing lock structure, would be necessary in the event of a major flood event. Such flood fighting measures would exert damaging loads on the lock structure, and likely cause permanent damage to the lock. No further consideration was given to this alternative.

c. **Flood Control/Navigation Plans**. Alternative navigation plans include the construction of a larger replacement lock at Bayou Sorrel Lock, the replacement of bridges crossing the Atchafalaya River; and small scale improvements to increase the navigation efficiency at the other locks in the GIWW system. The flood control/navigation plans would provide for measures to pass the FC,MR&T project flood at Bayou Sorrel, and would provide for measures to reduce delays to navigation at Bayou Sorrel Lock.

1. **Larger Replacement Lock.** This plan would provide for the construction of a replacement lock at Bayou Sorrel with larger chamber dimensions than the existing lock. Two alternative chamber widths were considered, 75 and 110 feet. Only a 1,200-foot chamber length was considered as previously discussed in the section, Plan Formulation Rationale. The 75- and 110-foot widths were selected based on the packing of the lock chamber with combinations of the various-width barges projected to move through a new lock over the planning horizon for the project.

In addition to width, we considered both concrete and earthen chambers for the replacement locks. The construction duration for the concrete-chambered locks is about 3-years. The earthen-chambered locks cost less than their concrete counterparts; however, the construction duration for earthened-chamber locks is about 5.5 years. Poor soil conditions at the site of the replacement lock require a longer construction period to allow for consolidation of the earthen lock walls. The longer construction period delays the increase in benefits from the larger lock, which results lowers the benefits for the earthened-chambered locks.

This resulted in 4 combinations of lock sizes and chamber types:

(a) 75- by 1,200- by -15 foot earthen chamber
(b) 75- by 1,200- by -15 foot concrete chamber
(c) 110- by 1,200-by - 15 foot earthen chamber
(d) 110- by 1,200-by – 15 foot concrete chamber

There are no relocations of bridges or utilities required for this plan.

The new locks will be built on existing fee-owned land (262 acres). The construction of this project will require 273.2 acres of new fee-owned land and 102.4 acres of easement. One landowner owns all new right-of-way. All of the land that will be required in fee is already encumbered with Corps of Engineers easements for the Gulf Intracoastal Waterway-Alternate Route or the East Access Channel, or with a levee easement held by the Atchafalaya Basin Levee District.

Erosion protection will be provided within 1 and ½ miles north and to the south of the new lock location. Grading/dressing of the underwater bank lines and placement of a 2-foot layer of rock paving will minimize the wave damage resulting from prop-wash. In combination with the stone placement, 14 mooring buoys in the vicinity of the lock and 13 north of the Bayou Sorrel Bridge will be provided for barge traffic to safely tie up while waiting to transit the lock.

With this plan, there are five structures that would be removed from lands over which the Government has easements. These structures, consisting of mobile homes and small wood frame houses, are located on land over which the United States holds a perpetual channel easement for the GIWW. These structures were moved onto the property after the Government acquired its interest. The owners of these structures are not entitled to compensation and benefit payment under the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law91-646) costs are not applicable. However, the tenants of these structures will be reimbursed for expenses incurred for moving their personal items.

Lock and channel construction and dredged material disposal would directly affect 240.4 acres of land. Of the 240.4 acres, 143.7 acres exist as dredged material disposal areas that are in various stages of regeneration. About 45.1 acres are considered disturbed bottomland hardwood forest. The remaining 51.6 acres is disturbed bottomland hardwood forest on Government owned property. With a new lock in place, dredged material from maintenance dredging would be placed in the old lock chamber and the old connecting channels for about 35 years after completion of the project.

2. **Bridge Replacements on the Atchafalaya River Navigation Channel.** This plan would provide for the implementation of one of the previously-described flood control plans at Bayou Sorrel Lock, and for the replacement of bridges crossing the Atchafalaya River at Simmesport and Krotz Springs, Louisiana, to reduce the hazard to navigation caused by the combination of strong river currents and

poorly aligned bridge openings. One bridge at each location would be replaced to provide a safe alignment for barge tows. The bridges groups include the Louisiana Highway 1 bridge and Louisiana and Arkansas Railroad bridge at Simmesport, Louisiana, and the old U.S Highway 190 bridge, the new U.S. Highway 190 bridge, and the Missouri-Pacific Railroad bridge at Krotz Springs, Louisiana. The Atchafalaya River is about 2,500 feet wide at Simmesport and is 49 feet deep below the mean high water level. The river is 3,000 feet wide at Krotz Springs and is 51 feet deep, below the mean high water level. The hazards to navigation increase as currents increase during seasonal high water periods. Based on preliminary estimates, the cost of replacing a bridge at Simmesport and a bridge at Krotz Springs would be very high. There is also a high degree of uncertainty over whether tow operators would use the Atchafalaya River during high water periods, even with the replacement bridges, due to the strong river currents. Therefore, no further consideration was given to this alternative.

3. **Small-Scale Improvements at other GIWW Locks.** These are not stand-alone flood control/navigation plans; they are increments to navigation plans for Bayou Sorrel Lock. Small-scale improvements at existing locks in the system, other than Bayou Sorrel Lock, could increase their capacities and thereby impact the optimum lock size of a replacement lock at Bayou Sorrel Lock. A capacity increase at Bayou Sorrel Lock may significantly reduce delays for barge tows moving through the lock; however, the delays may move to the next lock in the system, if the capacity at the next lock in the system were inadequate. Small-scale improvements that increase the capacity of the other locks in the system could result in an overall system benefit that could justify a larger capacity lock at Bayou Sorrel. The small-scale improvements evaluated are:

   - Realignment of approach channels to facilitate barges lining up with the locks, thereby reducing tow entry times.
   - Raising the height of guide walls to accommodate lightly-loaded barges reducing accident assessment closures.
   - Acquiring a spare pair of lock gates to significantly reduce de-watering closure time.
   - Constructing mooring facilities on both approaches to the locks to facilitate tow staging and alignment.
   - Adding helper boats to assist tow approaches.

Some of the small-scale improvements are being implemented for various reasons under the operation and maintenance program for the locks. It was determined that the remaining small-scale improvements at other locks have no effect on the lock capacity at Bayou Sorrel. No further consideration was given to these measures.

3. Evaluation and Screening of Alternative Plans

Flood-fighting at Bayou Sorrel Lock, small-scale improvements at other locks in the GIWW system, and the replacement of bridges on the Atchafalaya River were eliminated from further consideration based on preliminary evaluation and judgment. The remaining plans were further evaluated to determine the best plan, from an overall standpoint, for recommendation.

The first step in the evaluation and screening of alternative plans was to determine the best plan for passing the FC,MR&T project flood at Bayou Sorrel. The cost of this flood control plan would be allocated to flood control and would be the base plan, or without project condition, for the evaluation and screening of the combined flood control and navigation plans. The second step in the evaluation and screening process was to develop the best plan from an overall standpoint, based on both flood control and navigation needs.

a. Evaluation and Screening of Flood Control Plans

The two flood control plans that were further evaluated were the independent floodgate plan and the replacement-in-kind lock plan.

1) Effects of Flood Control Plans

Both the independent floodgate plan and the replacement-in-kind lock plan would provide for the safe passage of the FC,MR&T project flood at Bayou Sorrel. Both plans would provide protection for a flood elevation of 28.7 NGVD in the Atchafalaya Basin Floodway, plus three feet of freeboard. The independent flood gate plan would require the total closure of the Morgan City-to-Port Allen Route of the GIWW for a period of 60 days and 8-hour a day closures for an additional 490 days. The replacement-in-kind lock plan would not require any significant closures of the route to navigation.

2) Economic Analysis of Flood Control Plans

Both the independent floodgate plan and the replacement-in-kind lock plan would be inseparable features of the FC,MR&T project, and their costs are included in the overall costs for the project. Inseparable features of the FC,MR&T project are not incrementally evaluated. Generally, the most cost-effective plan is develop for providing project flood protection.

Based on 2000 price levels, the remaining costs of the FC,MR&T project are $88,870,000, the remaining benefits are $3,523,100,000, and the remaining benefit-to-cost ratio is 39.6. The costs of the two flood control only plans addressed in this feasibility are insignificant relative to the overall costs of the FC,MR&T project and would not have any significant effect on the justification economic of the overall project. Therefore, the criteria for plan selection for the flood control plans would be the least cost.

The costs of plan implementation and the costs of delays to navigation were developed to determine the best flood control plan, from an economic standpoint. A summary of the average annual costs at a common base year of the two plans is presented in Table 3-3. The In-Kind Replacement is the least-cost plan.

Table 3 – 3
Average Annual Costs
In-Kind Replacement vs. Gated Structure[1]

	In-Kind Replacement	Gated Structure
Construction with E&D Costs	4,337,284	1,903,293
O&M Costs	1,314,879	1,516,594
Construction Management Costs	267,952	119,672
Mitigation Costs	6,201	-
Real Estate Costs	7,324	-
Total Closure Cost to Navigation	-	2,451,713
Total Costs	5,933,640	5,991,272

[1] Based on an interest rate of 5.875% and a 50-year project life.

3) Screening of Flood Control Only Plans

The average annual costs of the in-kind replacement lock plan are $5,933,640, and the costs of the independent float-in-floodgate are $5,991,272. The average annual costs of the in-kind replacement lock is $57,632 less than the average annual costs of the independent float-in-floodgate, and the net environmental impacts of the two plans are similar; therefore, the in-kind replacement lock was determined to be the best flood control plan from an overall standpoint.

b. Evaluation and Screening of Flood Control/Navigation Plans

The only alternatives considered further for providing for flood control and for improving navigation at Bayou Sorrel Lock were larger replacement locks. Each of the plans provided for a replacement lock adjacent to the existing lock. The four plans are all provide for a 1,200-foot long chamber with a sill elevation of –15 feet NGVD with varying widths and chamber construction. The plans are:

a) 75 feet wide, earthen chamber

b) 75 feet wide, concrete chamber

c) 110 feet wide, earthen chamber

d) 110 feet wide, concrete chamber

1) Effects of Flood Control/Navigation Plans on Inland Navigation

The replacement lock plans would provide for the safe passage of the FC,MR&T project flood at Bayou Sorrel. Both plans would provide protection for a flood elevation of 28.7 feet NGVD in the Atchafalaya Basin Floodway, plus three feet of freeboard.

The replacement lock plans would each provide for a significant reduction in delays to inland barge traffic moving over the Morgan City to Port Allen route of the GIWW. The effect of these reductions in delays varies with the width and chamber construction of the locks. A systems analysis of the GIWW system was conducted to evaluate these delays. The General Equilibrium Model (GEM), a computer model, was used to estimate delays in the GIWW system, with and without the various alternative Bayou Sorrel larger lock replacement plans. GEM has the capability to estimate the transportation benefits for movements having alternative waterway routings. This is particularly important for the Bayou Sorrel Lock study since most of the commercial traffic moving along the Gulf Intracoastal Waterway has the choice of using several different waterways to get to its final destination.

GEM was run to estimate the total transportation cost savings (NED benefits) attributable to the with- and without-project conditions. The model was used to estimate the benefits to the existing and improved systems for calendar years 1992, 2000, 2010, 2020, 2030, 2040, and 2060. For intermediate years, the system transportation benefits are estimated by assuming a linear change in benefits between the years explicitly modeled. Detailed information on the GEM model and the model results are presented in Volume 2, Economic Appendix. Summary information is presented below.

The results of the GEM model runs for the without-project condition are presented in Table 3 - 4. Displayed are the annual tonnages and expected levels of delay for each lock in the modeled system locks, and annual tonnage moved on the entire system. (Note that system tonnage does not include tonnage that does not transit at least one of the modeled GIWW locks.) The following paragraphs are observations regarding the model results for the without-project condition.

The with-project scenarios consist of the four combinations of lock sizes and chamber construction for larger replacement locks at Bayou Sorrel. The concrete-and earthen-chambered locks are modeled as separate plans because the chamber construction affects emptying and filling times for the locks, which affects the lock capacities. Average annual delays per tow for the without-project condition and the four replacement lock plans are presented in Table 3-5. The total traffic (tonnage) accommodated at Bayou Sorrel Lock for the without-project condition and the four alternative plans is presented in Table 3-6. The changes in traffic at each of the locks on the modeled system, including Bayou Sorrel Lock, is presented in Table 3-8 for the without-project condition and the four replacement lock plans at Bayou Sorrel. The following paragraphs are observations regarding the model results.

The data presented in Table 3-5 show a significant reduction in delays at Bayou Sorrel Lock over the 50-year planning horizon, with the larger replacement lock plans.

Table 3 - 6 shows the traffic accommodated, or processed, at the Bayou Sorrel lock. Table 3 - 7 expresses these same traffic volumes as a percent of total unconstrained demand. Tables 3 - 6 and 3 - 7 demonstrate that in the early years accommodated traffic was greater than total demand for the without- project and with-project alternatives. This result is due to the fact that GEM had routed some movements onto the Morgan City-to-Port Allen alternate route that originally did not use the alternate route because, for these movements, alternate route transportation costs were less expensive than the original route. Table 3 – 7 also shows that in the later years, a large proportion of total demand is not accommodated in the without-project condition and, although less so, in the with-project conditions as well. The reason why this affect occurs in the with-project conditions is because nearly 100 percent of Bayou Sorrel lock traffic also passes through Port Allen lock. Consequently, even though the larger locks at Bayou Sorrel lock decrease its traffic overall delay costs, it still has to incur high delays at Port Allen lock.

Table 3 – 9 displays the total system transportation savings by year for the without-project condition and the total system and incremental transportation savings by year for each with-project alternative. System transportation cost savings represent the total transportation cost savings attributable to the entire modeled system network. Incremental transportation cost savings represents the portion of total system transportation cost savings attributable to the potential improvement under consideration (measured as the difference between with and without-project total transportation cost savings).

Table 3 – 4

Without Project Conditions
Tonnages and Delays by Lock

Lock	1992 Tons (Millions)	1992 Delay (Hrs)	2000 Tons (Millions)	2000 Delay (Hrs)	2010 Tons (Millions)	2010 Delay (Hrs)	2020 Tons (Millions)	2020 Delay (Hrs)
Old River	7,822	0.15	9,168	0.18	11,178	0.23	17,587	0.45
Port Allen	23,244	1.20	26,650	1.82	30,152	3.08	30,395	3.22
Bayou Sorrel	**22,554**	**2.32**	**25,817**	**4.25**	**29,170**	**12.74**	**29,287**	**15.03**
IHNC	20,830	6.31	25,071	20.33	25,976	32.79	26,158	37.20
Algiers	21,837	2.37	22,262	2.64	23,767	4.17	25,028	7.35
Harvey	3,797	0.62	4,317	0.75	6,204	1.46	8,473	3.44
Bayou Boeuf	25,915	1.24	26,967	1.42	29,780	2.09	33,238	3.95
Leland Bowman	40,533	0.32	44,348	0.36	50,964	0.44	58,725	0.55
Calcasieu	40,359	1.53	43,853	1.75	50,258	2.21	57,890	2.90
Total Tons (Ktons)	80,301		88,683		97,598		107,602	
Total Net Benefits (millions $)	824.2		862.1		929.2		1,036.5	
Savings per Ton (Kton)	10.26		9.72		9.52		9.63	

Lock	2030 Tons (Millions)	2030 Delay (Hrs)	2040 Tons (Millions)	2040 Delay (Hrs)	2060 Tons (Millions)	2060 Delay (Hrs)
Old River	26,479	1.01	37,820	3.79	44,467	93.49
Port Allen	30,689	3.39	31,341	3.85	32,687	5.22
Bayou Sorrel	**29,438**	**17.53**	**29,927**	**28.90**	**30,649**	**114.57**
IHNC	26,158	37.20	26,397	45.00	26,619	55.60
Algiers	25,966	15.29	26,414	29.90	26,767	110.42
Harvey	10,393	10.94	11,041	25.09	11,461	104.98
Bayou Boeuf	36,002	9.66	36,667	14.11	36,702	14.46
Leland Bowman	68,039	0.70	78,844	0.92	84,912	1.07
Calcasieu	67,054	4.03	77,707	6.08	83,950	7.98
Total Tons	119,209		132,211		142,229	
Total Net Benefits (millions $)	1,149.1		1,231.3		989.4	
Savings per Ton	9.64		9.31		6.96	

Table 3 – 5

Average Annual Delays at Bayou Sorrel Lock
for Existing Conditions and Alternative Larger Replacement Lock Plans
(Hours)

Condition	1992	2000	2010	2020	2030	2040	2060
Without Project	2.3	4.3	12.7	15.0	17.5	28.9	114.6
1,200 x 75 Concrete Chamber	-	-	0.9	1.2	1.2	1.2	1.3
1,200 x 75 Earthen Chamber	-	-	1.2	1.6	1.8	2.0	2.0
1,200 x 110 Concrete Chamber	-	-	0.6	0.7	0.7	0.7	0.7
1,200 x 110 Earthen Chamber	-	-	0.6	0.7	0.7	0.7	0.8

Table 3 – 6

Bayou Sorrel Traffic Accommodated
By Alternative and Year
(1,000 Tons)

Condition	1992	2000	2010	2020	2030	2040	2060
Without Project	22,554	25,817	29,170	29,287	29,438	29,927	30,649
1,200 x 75 Earthen	-	-	29,170	34,231	34,382	34,649	35,193
1,200 x 75 Concrete	-	-	30,662	34,285	34,444	34,690	35,195
1,200 x 110 Earthen	-	-	30,735	34,336	34,472	34,711	35,196
1,200 x 110 Concrete	-	-	30,735	34,339	34,475	34,713	35,196

Table 3 – 7

Bayou Sorrel Lock Percent of Total Demand Accommodated
By Alternative and Year

Condition	1992	2000	2010	2020	2030	2040	2060
Without Project	103%	103%	98%	85%	73%	63%	46%
1,200 x 75 Earthen	-	-	98%	99%	85%	73%	53%
1,200 x 75 Concrete	-	-	103%	99%	85%	73%	53%
1,200 x 110 Earthen	-	-	103%	99%	85%	73%	53%
1,200 x 110 Concrete	-	-	103%	99%	85%	73%	53%

Table 3 – 8

Changes In System Traffic
By Alternative and Year
(1,000 Tons)[1]

Lock	W/O Project Traffic	1,200 x 75 Earthen	1,200 x 75 Concrete	1,200 x 110 Earthen	1,200 x 110 Concrete
		1992			
Old River	7822	-2	-2	-2	-2
Port Allen	23244	322	336	451	451
Bayou Sorrel	**22554**	**322**	**336**	**451**	**451**
IHNC	20830	0	0	0	0
Algiers	21837	-127	-131	-228	-230
Harvey	3797	-193	-203	-221	-219
Bayou Boeuf	25915	-321	-335	-450	-450
Leland Bowman	40533	0	0	0	0
Calcasieu	40359	0	0	0	0
Total System	80301	0	0	0	0
		2000			
Old River	9168	0	-2	-2	-2
Port Allen	26650	205	398	410	410
Bayou Sorrel	**25817**	**204**	**398**	**410**	**410**
IHNC	25071	0	0	0	0
Algiers	22262	-72	-151	-155	-155
Harvey	4317	-134	-246	-253	-253
Bayou Boeuf	26967	-204	-395	-407	-407
Leland Bowman	44348	0	0	0	0
Calcasieu	43853	0	0	0	0
Total System	88683	0	0	0	0
		2010			
Old River	11178	-619	-619	-619	-619
Port Allen	30152	1466	1480	1553	1553
Bayou Sorrel	**29170**	**1478**	**1492**	**1565**	**1565**
IHNC	25976	0	0	0	0
Algiers	23767	-207	-210	-227	-227
Harvey	6204	-639	-650	-706	-706
Bayou Boeuf	29780	-225	-239	-312	-312
Leland Bowman	50964	0	0	0	0
Calcasieu	50258	0	0	0	0
Total System	97598	0	0	0	0

Table 3 – 8 (cont.)

Changes In System Traffic
By Alternative and Year
(1,000 Tons)[1]

Lock	W/O Project Traffic	1,200 x 75 Earthen	1,200 x 75 Concrete	1,200 x 110 Earthen	1,200 x 110 Concrete
		2020			
Old River	17587	-4638	-4697	-4741	-4744
Port Allen	30395	4930	4985	5036	5038
Bayou Sorrel	**29287**	**4944**	**4998**	**5049**	**5052**
IHNC	26158	0	0	0	0
Algiers	25028	-75	-870	-75	-75
Harvey	8473	-217	-213	-218	-218
Bayou Boeuf	33238	-98	-103	-96	-96
Leland Bowman	58725	0	0	0	0
Calcasieu	57890	0	0	0	0
Total System	107602	0	0	0	0
		2030			
Old River	26479	-4817	-4872	-4900	-4903
Port Allen	30689	4944	4991	5019	5022
Bayou Sorrel	**29438**	**4944**	**5006**	**5034**	**5037**
IHNC	26158	0	0	0	0
Algiers	25966	-44	-41	-41	-41
Harvey	10393	-74	-70	-70	-70
Bayou Boeuf	36002	-95	-87	-87	-87
Leland Bowman	68039	7	7	7	7
Calcasieu	67054	7	7	7	7
Total System	119209	24	24	24	24
		2040			
Old River	37820	-3647	-3655	-3676	-3678
Port Allen	31341	4722	4744	4765	4767
Bayou Sorrel	**29927**	**4722**	**4763**	**4784**	**4786**
IHNC	26397	0	0	0	0
Algiers	26414	-130	-136	-136	-136
Harvey	11041	-165	-172	-173	-173
Bayou Boeuf	36667	-45	-46	-48	-48
Leland Bowman	78844	175	175	175	175
Calcasieu	77707	175	175	175	175
Total System	132211	767	767	767	767

Table 3 – 8 (cont.)

Changes In System Traffic
By Alternative and Year
(1,000 Tons)[1]

Lock	W/O Project Traffic	1,200 x 75 Earthen	1,200 x 75 Concrete	1,200 x 110 Earthen	1,200 x 110 Concrete
			2060		
Old River	44467	-43	-43	-43	-43
Port Allen	32687	4244	4246	4247	4247
Bayou Sorrel	**30649**	**4544**	**4546**	**4547**	**4547**
IHNC	26619	69	69	69	69
Algiers	26767	-16	-16	-16	-16
Harvey	11461	-16	-16	-16	-16
Bayou Boeuf	36702	-6	-5	-5	-5
Leland	84912	3779	3781	3782	3782
Bowman Calcasieu	83950	3421	3421	3421	3421
Total System	142229	4101	4103	4104	4104

[1]It should be noted that recent declines in coal traffic moving through the IHNC Lock has caused average delays per tow to be not as severe as was projected. An investigation is currently underway to determine the long-term or short-term nature of the decline. In either case, this will have no impact on the outcome of this analysis since there is essentially no common traffic between the Bayou Sorrel Lock and the IHNC Lock

Table 3 – 9

Total Transportation Costs and Incremental Transportation Savings
(1997 Prices)

Condition	1992	2000	2010	2020	2030	2040	2060
Without Project Costs	824,183,381	862,063,573	929,246,883	1,036,538,458	1,149,063,115	1,231,283,916	989,377,207
1,200 x 75 Earthen							
Total Cost	826,355,585	866,979,701	947,611,316	1,041,286,918	1,154,547,836	1,259,617,923	1,042,848,369
Incremental Savings	2,172,204	4,916,128	18,364,433	4,748,460	5,484,721	28,334,007	53,471,162
1,200 x 75 Concrete							
Total Cost	826,457,395	867,222,359	948,100,972	1,041,271,959	1,154,412,552	1,260,544,837	1,042,716,386
Incremental Savings	2,274,014	5,158,786	18,854,089	4,733,501	5,349,437	29,260,921	53,339,179
1,200 x 110 Earthen							
Total Cost	826,771,039	867,600,587	948,671,410	1,041,301,979	1,154,654,876	1,260,572,911	1,042,624,878
Incremental Savings	2,587,658	5,537,014	19,424,527	4,763,521	5,591,761	29,288,995	53,247,671
1,200 x 110 Concrete							
Total Cost	826,763,125	867,600,587	948,693,145	1,041,302,365	1,154,653,449	1,260,575,999	1,042,614,677
Incremental Savings	2,579,744	5,537,014	19,446,262	4,763,907	5,590,334	29,292,083	53,237,470

2) Environmental Effects of Flood Control/Navigation Plans

Environmental impacts will essentially be the same for each of the four replacement lock plans at Bayou Sorrel. Most of the impacts of the project would result from dredging of the connecting channels, relocating the East Access Channel, and dredged material disposal. A primary focus of mitigation planning was to avoid and minimize adverse impacts to cypress swamp and bottomland hardwood forest within the Atchafalaya Basin. These habitats are of special concern to resources agencies and local residents.

Lock and channel construction would directly affect 240.4 acres of land. Of these 240.4 acres, 143.7 acres are dredged material disposal areas, and the remaining 96.7 acres are disturbed bottomland hardwood forest in various stages of woodland succession. The 240.4 acres would be converted to 88.9 acres of new channel; 27.6 acres of new lock grounds; 113.4 acres of dredged material disposal area; and 10.5 acres of forest with an altered hydrology (isolated from river flow). About 46 acres of the dredged material disposal areas would be planted with desirable tree species, including oaks, sugarberries, and hickories, and managed for maximum habitat value. These areas would eventually provide a higher habitat value than if they had not been used for disposal and planted thus providing mitigation credit. Dredged material from channel construction would also be placed into two existing borrow pits along Lower Grand River. No mitigation for filling-in the borrow pits is proposed. During project construction and during maintenance dredging of the GIWW after the project is completed, dredged material would be deposited in open water areas and existing channels that would no longer be necessary for navigation. These areas include the old lock chamber, the old forebay and tailbay channels, and blocked-off section of the East Access Channel, which comprise about 132.5 acres. These areas (except for the borrow pits) would be reforested with desirable tree species, such as oaks, sugarberries, and hickories, as they become filled to capacity. Some areas would be filled within 5 years after project construction, while others would take about 35 years to fill.

Under the existing maintenance dredging program for the GIWW, new dredged material disposal areas are developed in the Atchafalaya Basin Floodway near Bayou Sorrel as needed to contain material dredged during annual maintenance dredging. Under the with-project condition, about 280 acres of forested land within the Atchafalaya Basin Floodway, much of which is existing dredged material disposal area, would experience a difference in the amount of time it would take to reach its capacity for containing dredged material compared to the without project condition. Under the future without project condition, dredged material from annual maintenance dredging would continue to be placed in existing dredged material disposal areas, and new dredged material disposal areas would be constructed as necessary. With a new lock in place, dredged material from maintenance dredging would be placed in the old lock chamber and old connecting channels for about 35 years after completion of the project. Benefits in terms of preserved habitat accrue since these areas would be adversely affected in the absence of lock replacement project, whereas there would be no adverse affect on these areas for many years under the proposed plan.

Features included in the four lock replacement plans would mitigate the net adverse impacts to fish and wildlife resources. Mitigation planning for a lock replacement project began by determining the extent of impact the project would have on the landscape of the area. After the footprint of the project was determined, options to avoid and minimize impacts were investigated. Most of the potential for avoiding and minimizing impacts was determined to lie in the plan for dredged material disposal. Local interests and the U.S. Fish and Wildlife Service suggested using existing borrow pits in the area for dredged material disposal to lessen the need for disposing material on forested lands. The dredged material disposal plan includes using two borrow pits, and a canal connecting them, for dredged material disposal. Those pits would be sufficient to contain all of the material dredged from the new lock's tailbay channel (the channel extending north from the new lock). A decision was also made to utilize existing disposal areas to the maximum extent practicable for disposal of material dredged during project construction.

All of the material that would be dredged from the new lock's south entrance channel would be deposited in existing dredged material disposal areas. After the new lock becomes operational and connecting channels are dredged, the East Access Channel would be realigned along the west side of the new lock's forebay channel so that the strong current often found in the East Access Channel would not interfere with vessels entering and exiting the south end of the new lock. Material from the realigned East Access Channel would be deposited in the old lock's tailbay and forebay channels. By doing so, impacts to forested areas are avoided. To quantify impacts to forested areas and determine the amount of mitigation required to compensate for the impacts, models developed for wetlands mitigation planning by the State of Louisiana and other resource agencies was used. The models are called simply Habitat Assessment Models or HAM. After extensive analyses, it was determined that direct project impacts to forested lands could be mitigated by reforesting project lands. The model results show that the project would cause the loss of 70.10 average annual habitat units, while the mitigation plan would compensate for 72.33 average annual habitat units, resulting in a net positive 2.23 average annual habitat units.

The project plan for dredged material disposal avoids and minimizes impacts to forested areas to a large degree. No forested lands would be used for dredged material disposal, except for those lands already used for that purpose. The compensatory mitigation plan, required after avoidance and minimization is considered, would involve planting 126.5 acres of project lands with desirable tree species, monitoring their survival, replanting areas as necessary, reducing competing vegetation, and performing other tasks necessary to reforest project lands with a forest of high habitat value. The HAM does not adequately capture the environmental effects of the conversion of wet, bottomland hardwood forest nor upland-type habitat that does not get periodically flooded. Also, the habitat assessment models cannot adequately capture the effect that dredged material disposal areas have on nearby cypress swamps by blocking-off headwater flows. In order to mitigate for these two effects, additional mitigation is planned.

The mitigation plan provides for the construction of a new ditch through existing dredged material disposal sites to connect the East Access Channel with the swamp to the west of the disposal sites. The ditch would contain a sediment trap near its origin at the East Access

Channel in order to limit the amount of sand and silt that is carried into the swamp by the ditch. A sediment trap would also be built on an existing ditch located along the northern boundary of existing disposal sites. These features would be built during project construction. These mitigation features serve two purposes – mitigation and environmental restoration. Benefits attributable to the ditches described above are difficult to quantify. It is estimated, from analysis of water color patterns on aerial photography and field observations, that approximately 1,000 acres of habitat is being adversely affected by the presence of the dredged material disposal areas along the East Access Channel.

4. Summary of Economic Analyses of Flood Control/Navigation Plans

A summary of the economic analysis of the flood control/ navigation plans is presented in this section. The summary includes the construction costs, average annual costs, average annual benefits, average annual net benefits, and benefit-to-cost ratio. For an economic comparison of the plans, the stream of costs and benefits over the 50-year life of the project have been converted to average annual values, based on an interest rate of 5.875%. This purpose of this economic summary is to present the incremental costs and benefits for portion of the flood control/navigation plans allocated to inland navigation. All cost and benefit data are 2000 price levels. The hourly vessel operating costs developed by the U.S. Army Corps of Engineers Institute for Water Resources must be used for navigation economic analysis, and latest hourly operating costs available are 2000 price levels. All cost and benefits are presented at 2000 price levels to be comparable.

a. Costs. The construction costs by year and interest during construction for the in-kind replacement lock and the larger replacement lock plans is presented in Table 3-10. Interest during construction is applied to the portion of the construction costs expended prior to the initial accrual of benefits. For the cost analysis, the cost of the in-kind replacement plan is presented for cost allocation purposes. The incremental costs of the larger lock replacement plans allocated to inland navigation is the total costs of the larger lock replacement plans less the costs of the in-kind replacement lock.

The summary of construction costs includes two additional lock plans to determine if the economic stance of the earthen-chambered lock plans could be improved by the addition of wick drains to accelerate the consolidation of the lock walls. Wick drains would increase the costs of the earthen-chambered locks; however, the construction period would be shortened from 5-1/2 years to 3-1/2 years, which would increase the benefits. The cost of the earthen-chambered locks with wick drains would be higher than the same size concrete-chambered lock, and the benefits for the same size concrete-chambered lock would be higher than the earthen chambered lock because concrete locks would be constructed faster and have lower emptying and filling times. Therefore, earthen-chamber locks with wick drains were eliminated from further consideration.

A summary of the average annual costs of the alternative plans is presented in Table 3-11, including construction costs; engineering and design costs; operations, maintenance and replacement costs; construction management costs; real estate costs; and mitigation costs. The incremental average annual cost of the larger replacement lock plan that is allocated to inland navigation is also presented in Table 3-11.

b. Navigation Benefits. The average annual benefits for each of the larger replacement lock plans include savings to transportation costs of cargo moving over the inland waterway system due to the reduction in delays associated with an increase in the capacity at Bayou Sorrel Lock, and a reduction in accident costs associated with a wider lock chamber at Bayou Sorrel, and a reduction in the costs of vessels to assist tow operators in breaking down their tows for moving though the existing 56-foot wide x 797-foot long lock at Bayou Sorrel.

The benefits from a reduction in accident costs were developed from an analysis of the marine accident reports from New Orleans District, U.S. Army Corps of Engineers from 1990 to the present for various locks on the GIWW system. At the existing Bayou Sorrel Lock, it has been determined that approximately 8 accidents occur per year. At Calcasieu lock, which is 1,200 feet x 75 feet, and at Leland Bowman lock, which is 1,200 feet x 110 feet, it has been determined that at both locations, where traffic levels are essentially the same, approximately 1 accident occurs per year. Information obtained from the towing industry as well as from the New Orleans District's marine accident reports revealed that the cost per accident at the lock and for the tow was approximately $12,500 and $10,000, respectively. Consequently, these estimates were used in determining this benefit category.

An additional benefit to the towing industry is the avoided cost of hiring assist vessels whenever the tow has to cut itself in order to traverse the lock. Once again this is a function of the width of the lock. The narrower the chamber, the more likely a tow would have to break apart in order to traverse the lock. LPMS data on various locks on the GIWW system from the Corps of Engineer's Navigation Data Center provided estimates of multiple – cut lockages that are likely to occur in the with and without – project conditions. For the existing lock approximately 3200 tows per year are expected to hire assist vessels whereas for the larger with-project lock sizes all tows are expected to traverse the lock without tug assistance. According to local towboat operators, it currently costs approximately $250 per assistance.

The average annual benefits including reduction delays to inland navigation for the larger lock plans are summarized in Table 3-12.

Table 3 – 10
Construction Expenditures By Year for Alternative Plans[1]
(2000 Prices, 5.875 Percent Interest Rate)

Larger Replacement Lock Plans

Year	In-Kind Replacement	1200 x 75 x 15 Earth	1200 x 75 x 15 Earth w Drains	1200 x 75 x 15 Concrete	1200 x 110 x 15 Earth	1200 x 110 x 15 Earth w Drains	1200 x 110 x 15 Concrete
2005	4,399,813	5,410,063	20,360,745	9,761,585	5,902,563	21,211,954	10,809,939
2006			44,793,640	32,538,617		46,666,299	36,033,130
2007			12,216,447	26,085,470		12,727,172	28,531,629
2008	17,739,510	20,058,004	7,380,587		20,970,479	7,550,829	
2009	32,522,435	36,773,007			38,445,878		
Mid 2010	8,869,755	13,337,440			13,793,678		
Total	**63,531,513**	**75,578,514**	**84,751,419**	**68,385,672**	**79,112,598**	**88,156,254**	**75,374,698**
Interest During Construction	7,508,954	8,746,686	12,680,955	5,162,024	9,231,116	13,207,094	5,706,116

[1]Construction costs of floodgate and locks only; excludes mitigation costs, real estate costs, engineering and design costs, and construction management costs.
2Earthen-chambered locks with wick drains to accelerate consolidation of lock walls.

Table 3 – 11

Summary of Average Annual Cost of Alternative Plans
(2000 Prices, 5.875 Percent)

Lock Alternative	Base Year	Construction Costs With E&D	O&M[1] Costs	Construction Management Costs	Mitigation Costs	Real Estate Costs	Total Average Annual Costs	Incremental Total Average Annual Costs[2]
In-Kind Replacement	Mid 2010	5,002,665	1,516,594	309,058	7,152	8,448	6,843,918	
	Mid 2008						6,105,454	
	2008						5,933,640	
1200 x 75 x 15 Earthen	Mid 2010	5,939,679	1,625,215	374,432	7,152	8,448	7,954,926	1,111,008
1200 x 75 x 15 Earthen w Wick Drain	Mid 2008	6,757,035	1,625,215	432,518	7,152	7,537	8,829,457	2,724,003
1200 x 75 x 15 Concrete	2008	5,105,570	1,462,137	328,290	7,152	7,118	6,910,267	976,627
1200 x 110 x 15 Earthen	Mid 2010	6,222,124	1,476,899	392,857	7,152	8,448	8,107,481	1,263,563
1200 x 110 x 15 Earthen w Wick Drain	Mid 2008	7,029,535	1,476,899	449,672	7,152	7,537	8,970,796	2,865,342
1200 x 110 x 15 Concrete	2008	5,628,391	1,410,689	361,163	7,152	7,118	7,414,513	1,480,873

[1]Operation and maintenance costs.
[2]Incremental average annual costs allocated to inland navigation; excludes average annual costs allocated to the flood control, which is the average annual costs of the Independent Float-In Floodgate Plan, with the same base year.

c. **Economic Justification and NED Plan.** A summary of the total first cost and incremental economic analysis of the larger lock replacement plans is presented in Table 3 – 13. The average annual benefits and costs are the incremental benefits and costs of implementing the flood/control navigation plans (larger lock replacement plans) instead of the least-cost flood control plan, which is the Independent Float-In Floodgate Plan. Because all annual benefits and annual costs reflect the base year (the first year of project operation) of the alternative in question, it is necessary to account for the fact that alternatives have different implementation dates when identifying the alternative that generates the maximum net benefits. To account for this effect of differing base years, the net benefits of each alternative can be shifted forward or backward, using present value techniques, such that all alternatives reflect a common point in time. This adjustment is reflected in table 3-13 by using the year 2008 as the common reference point. It should be noted that the selection of a different common reference point does not affect the relative standing of alternatives; only the absolute amount of the net benefits would be affected.

All of the plans are economically justified with benefit-to-cost ratios ranging from 9.6 to 13.4. The National Economic Development (NED) plan is the one with the highest net benefits. Net benefits are the difference in average annual benefits and average annual costs. The larger lock replacement plan with a concrete chamber and dimensions of 1,200- by 75- by 15-feet has the highest net benefits ($15,081,336), and is designated as the NED plan.

Table 3 – 12

Summary of Average Annual Navigation Benefits for Larger Lock Replacement Plans[1]
(2000 Prices, 5.875 Percent)

Lock Alternative	Base Year	Navigation Benefits	Cost Savings due to Accidents & Assist Boats	Incremental Total Average Annual Benefits
1,200 x 75 x 15 Earthen	Mid 2010	14,783,346	1,281,972	16,065,318
1,200 x 75 x 15 Earthen w Drain	Mid 2008	14,811,989	1,279,562	16,091,551
1,200 x 75 x 15 Concrete	2008	15,023,747	1,275,750	16,299,497
1,200 x 110 x 15 Earthen	Mid 2010	15,236,437	1,281,972	16,518,409
1,200 x 110 x 15 Earthen w Drain	Mid 2008	15,302,077	1,279,562	16,581,639
1,200 x 110 x 15 Concrete	2008	15,291,646	1,275,750	16,567,396

Table 3 – 13

Summary of Incremental Economic Analysis of Larger Lock Replacement Plans
Mid-Growth Scenario
(2000 Prices, 5.875 Percent)

	1,200 x 75 x 15 Earthen	1,200 x 75 x 15 Concrete	1,200 x 110 x 15 Earthen	1,200 x 110 x 15 Concrete
Total First Cost	$89,100,000	$80,600,000	$93,200,000	$88,800,000
First Cost-Navigation	$13,761,000	$5,261,000	$17,861,000	$13,461,000
Total Annual Costs[2]	$1,111,008	$976,627	$1,263,563	$1,480,873
Total Annual Benefits	$16,065,318	$16,299,497	$16,518,409	$16,567,396
Net Benefits	$14,954,310	$15,322,870	$15,254,846	$15,086,523
Benefit-to-Cost Ratio	14.5	16.7	13.1	11.2
Base Year	Mid 2010	2008	Mid 2010	2008
Net Benefits Adjusted to 2008 Base Year	$12,965,307	$15,322,870	$13,225,871	$15,086,523

[1]Analysis of incremental navigation plans relative to the least-cost flood control plans, which is the Independent Float-In Floodgate Plan.
[2]Excludes average annual costs allocated to flood control.
[3]Net benefits are the difference in average annual benefits and average annual costs.

d. Alternative Floor/Sill Depths. The current NED plan involves a 1,200 x 75 x 15 foot concrete chamber replacement lock. In order to verify that the 15 foot depth is optimal, one additional floor depth, deeper than 15 feet, was investigated. One shallower than the 15 foot depth was not considered since this basically represented the limit for shallow draft traffic.

The rationale for looking at floor depths deeper than the original 15 foot depth, lies in the fact that deeper chambers generally result in faster fill and emptying times. A faster fill and empty time will produce a lower processing time, which ultimately translates, to a higher level of service. While investigating various floor depths and their corresponding empty and fill times for a 1,200 x 75 concrete chamber, it was determined that faster fill and empty times began to occur at a floor depth of 19 feet. On average, the expected value decrease in chambering time was 0.4 minutes across the range of head differentials.

Comparing the economics of a 1,200 x 75 x 19 foot concrete chamber revealed that total average annual benefits increased by only $7,000 over the total average annual benefits associated with the 1,200 x 75 x 15 foot NED plan. With such a small increase in the average annual benefits, it became obvious that this alternative floor depth would not be economically justified since the average annual cost of lowering the floor depth from 15 feet to 19 feet was expected to increase by $500,000. Consequently, the move to a deeper floor depth is not supported by economic criteria.

e. Sensitivity Analysis. Given the nature and complexity of the benefit measurement procedures, an unavoidable component of uncertainty is implicit in the estimates of project benefits. A single change to any number of parameter values or assumptions holds the potential for significantly affecting benefit estimates and ultimately, project formulation. The role of sensitivity analysis is to identify those parameters and assumptions with the greatest potential for project formulation impact and to evaluate the magnitude of those impacts for discrete changes in the key parameters. The parameters identified as potentially significant, and consequently incorporated into the sensitivity analysis, include traffic projections, the discount rate, and alternative design elevations for lock floor/sill construction. In the following paragraphs of this section, the impacts on project benefits and plan formulation resulting from alternative parameter values and assumptions are presented.

i. **High Growth Scenario.** Projected traffic volumes reflecting the high growth scenario have been developed by raising the traffic volumes projected in the mid growth scenario by 20 percent across the board for all commodity groups. The result of incorporating these projected traffic volumes into the system modeling on Bayou Sorrel lock, accommodated traffic, average delay and system benefits are detailed in tables 3 –14 through 3 – 16, respectively. Because of the greater overall system demand, traffic processed at Bayou Sorrel lock, shown in table 3 – 14, is higher for the high growth scenario compared to the mid growth scenario but not substantially higher. The reason lies in the fact that since practically all of Bayou Sorrel traffic must pass through Port Allen lock this traffic must still withstand substantial delays (particularly in the later years) at Port Allen lock. The result is that large volumes of traffic continue to be diverted off the system even though improvements at Bayou Sorrel lock have been made. Table 3 – 15 displays the average delays per tow expected in the without and with-project conditions assuming high traffic growth. As expected, average delays are significantly higher for the without-project condition in the high growth scenario than the mid growth scenario. For the with-project lock improvement plans there are only minor differences in average delay. Throughout the 50 year time frame the percent of utilized capacity remains sufficiently low even with the high growth scenario. Table 3 – 16 displays the system benefits for the high growth scenario. It reveals that for the with-project alternative lock plans, high growth average annual savings are approximately 60 percent higher than the mid growth average annual savings. The higher level of traffic demand associated with the high growth scenario generates more tons that still experience relatively low delays resulting in the much higher system benefits. Table 3 – 17 and 3 – 18 displays the average annual benefit summary and the average annual benefit – cost summary, respectively for the high traffic growth scenario. The average annual cost summary for the high growth scenario is the same as that in the mid growth scenario. Table 3 – 18, reveals that the high growth scenario causes no change in the NED plan (1,200 x 75 x 15 ft concrete lock) as compared to the mid growth projections with average annual net benefits totaling $22.0 million.

ii. **Low Growth ("No Growth") Scenario.** Since the average annual benefit – cost summary results of the mid growth scenario, displayed in table 3 – 13, showed substantial average annual net benefits for all the with – project lock alternatives, it was decided to run a "No Growth" scenario through the GEM in order to determine if this extreme case still produced economically justified with - project plans.

The "No Growth" scenario reflects a condition where the traffic volumes associated with the baseline traffic year of 1992 is held constant throughout the 50-year project life. The Average annual benefit summary, associated with this scenario is displayed in table 3 – 19. As with the high growth scenario, the average annual cost summary is not displayed since it is the same as that of the mid growth scenario. Table 3 – 20 displays the average annual benefit – cost summary for the "No Growth" scenario. As is shown, even with the assumption of no traffic growth, all the with – project lock alternatives are still economically justified and the NED plan continues to be a 1,200 x 75 x 15 foot chamber.

Table 3 –14

High Growth Scenario
Bayou Sorrel Traffic Accommodated
(1,000 Tons)

Condition	1992	2000	2010	2020	2030	2040	2060
Without Project	22,554	29,352	29,544	29,801	30,253	30,559	30,686
1,200 x 75 Earthen	22,876	31,852	34,309	34,391	34,798	35,176	34,911
1,200 x 75 Concrete	22,890	31,852	34,345	34,425	34,806	35,180	34,913
1,200 x 110 Earthen	23,005	31,853	34,385	34,457	34,820	35,182	34,913
1,200 x 110 Concrete	23,005	31,853	34,387	34,458	34,821	35,182	34,914

Table 3 – 15

High Growth Scenario
Bayou Sorrel Lock Average Delays
(Hours)

Condition	1992	2000	2010	2020	2030	2040	2060
Without Project	2.3	13.2	15.7	21.3	37.6	84.3	135.1
1,200 x 75 Concrete Chamber	0.6	1.0	1.1	1.2	1.2	1.3	1.3
1,200 x 75 Earthen Chamber	0.6	1.2	1.5	1.6	1.8	2.0	2.0
1,200 x 110 Concrete Chamber	0.4	0.6	0.7	0.7	0.7	0.7	0.7
1,200 x 110 Earthen Chamber	0.4	0.6	0.7	0.7	0.7	0.7	0.8

Table 3 – 16

High Growth Scenario
Total and Incremental Transportation Savings
(1997 Prices) ($)

Condition	1992	2000	2010	2020	2030	2040	2060
Without Project	824,183,381	984,499,121	1,079,034,260	1,175,667,099	1,233,241,574	1,075,704,976	996,001,892
1,200 x 75 Earthen	826,355,585	1,003,173,003	1,082,596,723	1,193,640,277	1,279,512,454	1,122,146,898	1,017,376,562
	2,172,204	18,673,882	3,562,463	17,973,178	46,270,880	46,441,922	21,374,670
1,200 x 75 Concrete	826,457,395	1,003,552,821	1,082,585,244	1,193,626,123	1,279,496,623	1,122,090,397	1,017,287,707
	2,274,014	19,053,700	3,550,984	17,959,024	46,255,049	46,385,421	21,285,815
1,200 x 110 Earthen	826,771,039	1,004,239,235	1,082,765,802	1,193,639,869	1,279,488,482	1,122,051,204	1,017,226,391
	2,587,658	19,740,114	3,731,542	17,972,770	46,246,908	46,346,228	21,224,499
1,200 x 110 Concrete	826,763,125	1,004,239,235	1,082,766,826	1,193,664,829	1,279,487,874	1,122,046,831	1,017,219,506
	2,579,744	19,740,114	3,732,566	17,997,730	46,246,300	46,341,855	21,217,614

Table 3-17

Average Annual Benefit Summary - High Growth Scenario
(2000 Prices, 5.875 Percent)

Lock Alternative	Base Year	Navigation Benefits	Cost Savings due to Accidents & Assist Boats	Incremental Total Average Annual Benefits
1,200 x 75 x 15 Earthen	Mid 2010	24,303,852	1,304,846	25,608,698
1,200 x 75 x 15 Concrete	2008	22,197,578	1,297,720	23,495,298
1,200 x 110 x 15 Earthen	Mid 2010	24,325,402	1,304,846	25,630,248
1,200 x 110 x 15 Concrete	2008	22,276,221	1,297,720	23,573,941

Table 3 – 18

Average Annual Benefit - Cost Summary
High Growth Scenario
(2000 Prices, 5.875 Percent)

	1,200 x 75 x 15 Earthen	1,200 x 75 x 15 Concrete	1,200 x 110 x 15 Earthen	1,200 x 110 x 15 Concrete
Total Annual Cost	1,111,008	976,627	1,263,563	1,480,873
Total Annual Benefits	25,608,698	23,495,298	25,630,248	23,573,941
Net Benefits	24,497,690	22,518,671	24,366,685	22,093,068
Benefit-to Cost Ratio	23.0	24.1	20.3	15.9
Base Year	Mid 2010	2008	Mid 2010	2008
Net Benefits Adj. to 2008	21,239,367	22,518,671	21,125,787	22,093,068

iii. **No Growth After 20 Years.** The "No Growth After 20 Years" scenario describes a condition where traffic is projected using the mid growth rates for only twenty years beyond the baseline traffic year. Given the 1992 baseline year, the terminal year of projections was set at 2010 for this scenario, since this was the closest GEM run to the year 2012. Beyond 2010, traffic is held constant at the 2010 level.

Table 3 – 21 displays the average annual benefit summary associated with this scenario and table 3 – 22 displays the average annual benefit – cost summary. As expected, table 3 – 22 shows, once again, that all the with-project plans are economically justified and that the 1,200 x 75 x 15 foot concrete chamber remains the NED plan.

iv. **Interest Rates.** Throughout this study an interest rate of 5.875 percent was used in determining average annual costs and benefits. In order to explore the implications of alternative interest rates on NED plan selection, two additional values (5.625 percent and 6.125 percent) will be presented.

Tables 3 – 23, 3 – 24 and 3 – 25 display the average annual cost summary, average annual benefit summary and the average annual benefit – cost summary for 5.625 percent. Tables 3 – 26, 3 – 27 and 3 – 28 display the same information for 6.125 percent. As the tables reveal, for both interest rates of 5.625 percent and 6.125 percent, all with-project plans continue to be economically justified and the 1,200 x 75 x 15 foot concrete chamber alternative remains the NED plan.

Table 3 – 19

Average Annual Benefit Summary - Low Growth Scenario
(2000 Prices, 5.875 Percent)

Lock Alternative	Base Year	Navigation Benefits	Cost Savings due to Accidents & Assist Boats	Incremental Total Average Annual Benefits
1,200 x 75 x 15 Earthen	Mid 2010	2,235,102	1,008,377	3,243,479
1,200 x 75 x 15 Concrete	2008	2,339,860	1,008,377	3,348,237
1,200 x 110 x 15 Earthen	Mid 2010	2,662,586	1,008,377	3,670,963
1,200 x 110 x 15 Concrete	2008	2,654,443	1,008,377	3,662,820

Table 3 – 20

Average Annual Benefit – Cost Summary
Low Growth Scenario
(2000 Prices, 5.875 Percent)

	1,200 x 75 x 15 Earthen	1,200 x 75 x 15 Concrete	1,200 x 110 x 15 Earthen	1,200 x 110 x 15 Concrete
Total Annual Cost	1,111,008	976,627	1,263,563	1,480,873
Total Annual Benefits	3,243,479	3,348,237	3,670,963	3,662,820
Net Benefits	2,132,471	2,371,610	2,407,400	2,181,947
Benefit-to-Cost Ratio	2.9	3.4	2.9	2.5
Base Year	Mid 2010	2008	Mid 2010	2008
Net Benefits Adj. to 2008 Base Year	1,848,841	2,371,610	2,087,203	2,181,947

Table 3 – 21

Average Annual Benefit Summary - No Growth After 20 Years
(2000 Prices, 5.875 Percent)

Lock Alternative	Base Year	Navigation Benefits	Cost Savings due to Accidents & Assist Boats	Incremental Total Average Annual Benefits
1,200 x 75 x 15 Earthen	Mid 2010	18,896,190	1,270,159	20,166,349
1,200 x 75 x 15 Concrete	2008	19,155,706	1,265,621	20,421,327
1,200 x 110 x 15 Earthen	Mid 2010	19,986,979	1,270,159	21,257,138
1,200 x 110 x 15 Concrete	2008	19,561,209	1,269,621	20,830,830

Table 3 – 22

Average Annual Benefit - Cost Summary
No Growth After 20 Years Scenario
(2000 Prices, 5.875 Percent)

	1,200 x 75 x 15 Earthen	1,200 x 75 x 15 Concrete	1,200 x 110 x 15 Earthen	1,200 x 110 x 15 Concrete
Total Annual Cost	1,111,008	976,627	1,263,563	1,480,873
Total Annual Benefits	20,166,349	20,421,327	21,257,138	20,830,830
Net Benefits	19,055,341	19,444,700	19,993,575	19,349,957
Benefit-to-Cost Ratio	18.2	20.9	16.8	14.1
Base Year	Mid 2010	2008	Mid 2010	2008
Net Benefits Adj. to 2008 Base Year	16,520,880	19,444,700	17,334,324	19,349,957

Table 3 – 23

Average Annual Cost Summary
(2000 Prices, 5.625 Percent)

Lock Alternative	Base Year	Construction Costs With E&D	O&M Costs	Construction Management Costs	Mitigation Costs	Real Estate Costs	Total Average Annual Costs	Incremental Total Average Annual Costs
In-Kind Replacement	Mid 2010	4,798,225	1,522,040	296,788	6,946	8,046	6,632,045	
	Mid 2008						5,944,482	
	2008						5,784,031	
1,200 x 75 x 15 Earthen	Mid 2010	5,697,361	1,629,955	359,622	6,946	8,046	7,701,930	1,069,886
1,200 x 75 x 15 Concrete	2008	4,908,497	1,463,692	315,800	6,946	6,828	6,701,763	917,732
1,200 x 110 x 15 Earthen	Mid 2010	5,968,088	1,480,478	377,303	6,946	8,046	7,840,861	1,208,816
1,200 x 110 x 15 Concrete	2008	5,411,096	1,412,305	347,418	6,946	6,828	7,184,593	1,400,562

Table 3 – 24

Average Annual Benefit Summary
(2000 Prices, 5.625 Percent)

Lock Alternative	Base Year	Navigation Benefits	Cost Savings due to Accidents & Assist Boats	Incremental Total Average Annual Benefits
1,200 x 75 x 15 Earthen	Mid 2010	14,973,204	1,280,870	16,254,074
1,200 x 75 x 15 Concrete	2008	15,162,286	1,274,771	16,437,058
1,200 x 110 x 15 Earthen	Mid 2010	15,422,841	1,280,870	16,703,711
1,200 x 110 x 15 Concrete	2008	15,425,012	1,274,771	16,699,784

Table 3 – 25

Average Annual Benefit – Cost Summary
Mid Growth Scenario
(2000 Prices, 5.625 Percent)

	1,200 x 75 x 15 Earthen	1,200 x 75 x 15 Concrete	1,200 x 110 x 15 Earthen	1,200 x 110 x 15 Concrete
Total Annual Cost	1,069,886	917,732	1,208,816	1,400,562
Total Annual Benefits	16,254,074	16,437,058	16,703,711	16,699,784
Net Benefits	15,184,188	15,519,326	15,494,895	15,299,222
BCR	15.2	17.9	13.8	11.9
Base Year	Mid 2010	2008	Mid 2010	2008
Net Benefits Adj. to 2008	13,242,646	15,519,326	13,513,624	15,299,222

Table 3 - 26

Average Annual Cost Summary
(2000 Prices, 6.125 Percent)

Lock Alternative	Base Year	Construction Costs With E&D	O&M Costs	Construction Management Costs	Mitigation Costs	Real Estate Costs	Total Average Annual Costs	Incremental Total Average Annual Costs
In-Kind Replacement	Mid 2010	5,211,203	1,511,232	321,548	7,360	8,862	7,060,205	
	Mid 2008						6,268,764	
	2008						6,085,175	
1200 x 75 x 15 Earthen	Mid 2010	6,186,831	1,620,618	389,505	7,360	8,862	8,213,176	1,152,971
1200 x 75 x 15 Concrete	2008	5,305,812	1,460,706	340,970	7,360	7,415	7,122,264	1,037,089
1200 x 110 x 15 Earthen	Mid 2010	6,481,240	1,473,523	408,688	7,360	8,862	8,379,673	1,319,468
1200 x 110 x 15 Concrete	2008	5,849,182	1,409,198	375,117	7,360	7,415	7,648,272	1,563,097

Table 3 – 27

Average Annual Benefit Summary
(2000 Prices, 6.125 Percent)

Lock Alternative	Base Year	Navigation Benefits	Cost Savings due to Accidents & Assist Boats	Incremental Total Average Annual Benefits
1,200 x 75 x 15 Earthen	Mid 2010	14,605,729	1,283,086	15,888,815
1,200 x 75 x 15 Concrete	2008	14,896,326	1,276,739	16,173,065
1,200 x 110 x 15 Earthen	Mid 2010	15,026,341	1,283,086	16,309,427
1,200 x 110 x 15 Concrete	2008	15,169,333	1,276,739	16,446,072

Table 3 -28

Average Annual Benefit - Cost Summary
Mid Growth Scenario
(2000 Prices, 6.125 Percent)

	1200 x 75 x 15 Earthen	1200 x 75 x 15 Concrete	1200 x 110 x 15 Earthen	1200 x 110 x 15 Concrete
Total Annual Cost	1,152,971	1,037,089	1,319,468	1,563,097
Total Annual Benefits	15,888,815	16,173,065	16,309,427	16,446,072
Net Benefits	14,735,844	15,135,976	14,989,959	14,882,975
BCR	13.8	15.6	12.4	10.5
Base Year	Mid 2010	2008	Mid 2010	2008
Net Benefits Adj. to 2008	12,700,791	15,135,976	12,919,812	14,882,975

5. Summary of Coordination and Public Views

a. **Public Meeting – May 6, 1997.** A notice of study initiation for replacement of the Bayou Sorrel lock was mailed to all known interested parties in December 1995. A notice of intent to prepare a draft EIS for the Intracoastal Waterway Locks feasibility study was published in the Federal Register on January 29, 1997. The description of the study, as contained in the Federal Register notice, referred only to the Bayou Sorrel lock. At the time of the notice, the study was referred to as the Intracoastal Waterway Locks study since previous reports and authorities included locks on the GIWW other than Bayou Sorrel. A public scoping meeting was held in the meeting hall of St. Catherine LaBouré Catholic Church in the community of Bayou Sorrel on May 6, 1997. Notices of the meeting were posted at various retail outlets in the area and mailed to interested parties. Eleven people attended the meeting. Attendees made the following comments at the public meeting:

- Little notification was given for the scoping meeting. A notice in the Post South newspaper would have reached most people in Bayou Sorrel.
- Bigger tows carrying hazardous chemicals would use the new lock.
- The Bayou Sorrel bridge has been damaged on several occasions by barge tows. Some of the protection pilings have not been replaced. When the bridge is out of service, there's no way to cross the waterway by vehicle.
- Private property is being lost along the banks of the channel from erosion.
- A bridge curfew is in effect on school days. The bridge does not open for vessels to pass from 6:00 to 8:30 a.m. and 3:00 to 4:30 p.m.
- There would be more frequent bridge openings with a new lock.
- There would be more traffic (either vessels or vehicles) during lock construction.
- Will the new lock require the relocation of residents or businesses?
- The old lock site could be used for a pump station to pump water into the basin (Atchafalaya Basin Floodway). High water outside of the Atchafalaya Basin Floodway is often a problem in Bayou Sorrel.

- The location of the new lock should be about 3 miles north of Bayou Sorrel.

- Use borrow pits outside of the basin for disposal of dredged material.

- A concrete lock should be built instead of an earthen chamber lock. An earthen chamber is cheaper, but a concrete lock is more efficient and has lower maintenance.

b. **Public Meeting – February 13, 2003.** A notice of the public meeting for replacement of the Bayou Sorrel lock was mailed to all known interested parties in January 2003. A notice of intent to prepare an EIS for the Bayou Sorrel Lock, Louisiana feasibility report was published in the Federal Register on November 15, 2002. A public scoping meeting was held at the Iberville Parish Council Chambers in Plaquemine, Louisiana on February 13, 2003. The meeting was well publicized in the Plaquemine, Louisiana Post/ South, Morgan City, Louisiana Daily Review, Franklin, Louisiana Banner-Tribune, and Baton Rouge Advocate newspapers. The articles are attached as Exhibits 5, 6, 7, and 8 respectively. Forty-One people attended the meeting. The meeting was recorded and a transcript as well as responses to comments is presented in Volume 7, Quality Control Plan, Technical Review, Public Meeting, Comments, and Responses of this report.

There were two overwhelming responses to this meeting; 1.) Stop the erosion by providing erosion control measures and/or 2.) Move the lock North of the town of Bayou Sorrel. Fifteen local residents spoke at the meeting, and all of them voiced their concern and frustration with continuous erosion of their private land. As a result the Waterways Journal, a weekly publication, the Pierre Part, Louisiana Cajun Gazette, and the Baton Rouge, Louisiana Advocate printed follow-up articles (Exhibits 9, 10, and 11). In addition, two of the five families that will need to relocate voiced their concern over not being reimbursed for their moving expenses.

c. **U.S. Fish and Wildlife Service Recommendations.** The U.S. Fish and Wildlife Service (FWS) has reviewed the various alternatives plans and provided comments. The FWS participated in an interagency habitat evaluation of project-site impacts and in the development of measures to mitigate the adverse impacts of the project construction. Mitigation measures recommended or agreed to by the FWS have been incorporated in the recommended lock plan. The FWS recommended nine specific measures and actions to mitigate system environmental impacts:

1. Maintaining and restoring headwater flows into Atchafalaya Basin swamps west of the disposal site would mitigate the loss of aquatic habitat functions of disturbed forested wetlands. To accomplish this, the effluent return ditch adjacent to the northern-most disposal area should be kept open to maintain the current hydrologic connection to the swamp west of that disposal site. A sediment trap (an enlarged opening that promotes sediment deposition) should be excavated at the confluence of that ditch and the EABPL borrow canal. The sediment trap should be installed at a location that will allow yearly excavation by equipment used in refurbishing the confined disposal site dikes. Material removed from the sediment trap should be placed within the confined disposal site or on the containment levees. An additional gap should be excavated at the southern end of this disposal site. That gap should have a general east-west orientation and should be approximately 50 feet wide (top width) and 1,300 feet long (ending at the western levees of the disposal site) with a sediment trap at the eastern end. The channel bottom should be the same elevation as the swamp floor.

2. Unavoidable project-related impacts on wildlife resources should be fully compensated by reforestation and management of 126.3 acres of bottomland hardwoods within the Bayou Sorrel Lock area of Iberville Parish.

3. Mitigation lands should be owned in fee; administration and management of those lands should be conducted in accordance with the Mitigation Plan as detailed in Appendix B of this Fish and Wildlife Coordination Act report. All mitigation lands should have land-use restrictions (e.g., non-development language) placed on their title. Acquisition, operation and management, and monitoring of mitigation lands should be a project expense.

4. If additional disposal sites for this project are constructed within the Basin, those sites should not exceed 2,000 feet in length (as measured parallel to the EABPL borrow canal or GIWW). A 200-foot-gap should be left between adjacent disposal sites to allow adequate overbank flows. Expansion of existing disposal sites should also adhere to the above length and gap specifications. During initial construction of confined disposal sites, all levee borrow should be excavated from outside the borrow pit. Outside borrow ditches or effluent return ditches should include a sediment trap that can be easily excavated with the equipment used to refurbish disposal site dikes. At all disposal sites, plugs should be installed in any inside borrow ditches to facilitate maximum sediment retention in the disposal areas prior to the effluent reaching the spill boxes.

5. Detailed design (e.g., design memoranda, plans and specifications, etc.) of the lock replacement and mitigation features should be prepared in consultation with the Service and the Louisiana Department of Wildlife and Fisheries.

6. Mitigation should be implemented simultaneously, to the extent feasible, with other project features.

7. The Corps should continue to coordinate with the Service to ensure that construction activities do not impact any waterbird nesting colonies or bald eagle nesting sites.

8. Budgets for development, operation and maintenance, and monitoring of the mitigation area should be included in future budgets and placed as a high priority within those budgets.

9. Detailed design of the lock should be coordinated with the Louisiana Department of Natural Resources' Atchafalaya Basin Program to ensure that no conflicts arise with the State of Louisiana's Master Plan for the Atchafalaya Basin.

d. **Navigation Interests**. Representatives of The Gulf Intracoastal Canal Association (GICA), The American Waterways Operators, and The Inland Waterway Users Board were requested to furnish data relevant to average industry cost for damages at 75-foot wide locks and floodgates vs. 110–foot wide structures. Each group participated in the Feasibility Review Conference held in November 2001 and had a chance to provide input in developing the NED plan. The Inland Waterway Users Board has been furnished status reports on the feasibility study on a regular basis. This project is listed on their priority job list, and the Project Manager routinely attends Board meetings.

6. Rationale for Recommended Plan

The Larger Lock Replacement Plans would provide for the safe passage of the FC,MR&T project flood at Bayou Sorrel and would provide for a significant reduction in the delays, and the associated transportation costs, of barge tows moving over the GIWW system. The Larger Replacement Lock Plan, with a concrete chamber and dimensions of 75 feet wide by 1,200 feet long by 15 feet deep, is economically justified and has the highest net benefits of all plans considered and is therefore the National Economic Development (NED) plan.

The new lock would be located adjacent to the existing lock, which results in lower impacts to the natural environment. Impacts to fish and wildlife resources were minimized and avoided, to the maximum extent practicable, in the development of the implementation plan, and the net adverse impacts, that could not be avoided, are mitigated by features added to the plan. Bank erosion and bridge delays to vehicular traffic caused by vessel traffic on the Morgan City-to-Port Allen alternate route of the GIWW are major concerns of residents in the Bayou Sorrel community north of the new lock. Vessel traffic is projected to increase over the 50-year planning horizon with the existing lock, however, the larger lock plans will not cause a significant increase in traffic projections. In response to concerns over erosion problems in the Bayou Sorrel area, erosion protection was added to the new lock replacement plans from the new lock northward through the Bayou Sorrel community for a distance of about 1-1/2 miles. There are no practicable measures to reduce delays to vehicular traffic caused by the increase in bridge openings.

The new lock would provide for the safe passage of the FC,MR&T project flood at Bayou Sorrel and would result in significant savings in transportation costs to inland navigation. The plan is the best plan, from an overall standpoint, for addressing flood control and navigation problems and needs at Bayou Sorrel Lock; its benefits far outweigh the remaining adverse impacts, and it is therefore selected as the recommended plan. The economic stance of the plan is not sensitive to changes in traffic projections, the discount rate, and alternative design elevations for lock floor/sill construction.

A summary of the economic analysis for the portion of the costs of the recommended plan allocated to inland navigation is presented in Table 3 - 29. All costs and benefits are based on 2000 price levels. Average annual costs were determined by converting the implementation costs and operation and maintenance costs to an equivalent average annual cost based on an interest rate of 5.875 %. The system-wide transportation costs with the recommended plan and with the existing Bayou Sorrel Lock were estimated and converted to an average annual basis using an interest rate of 5.875%. Average annual benefits were determined by subtracting the transportation costs with the existing lock from those with the recommended plan. The base year for the economic analysis, that is, the year the lock would become operational, is 2008.

The erosion protection and mooring buoy facilities were added to the all the alternatives following the public meeting held February 13, 2003 at a cost of $2,400,000, raising the first cost of the Recommended Plan to $83,000,000. The net effect of adding the erosion protection and mooring buoy facilities to all the alternatives does not change the selected plan. It should be noted that the estimated navigation benefits displayed in this analysis are prepared using FY 2000 Shallow Draft Vessel Operating Costs, which at the time of this write-up, continue to be the latest available from the U.S. Army Corps of Engineers Institute for Water Resources (IWR). As a result cost estimates are also displayed in 2000 price levels.

Table 3 - 29
Summary of Economic Analysis
of the Inland Navigation Component
of the Recommended Plan

Implementation Costs[1]	
Total Implementation Costs	$83,000,000
Less Cost Allocated to Flood Control	75,339,000
Total Implementation Costs-Inland Navigation	$7,661,000
Average Annual Costs[1,2]	
Construction Costs w/ E&D	$5,106,000
Lock Operation and Maintenance	1,462,000
Mitigation	7,152
Construction Management	328,000
Real Estate	7,118
Total Average Annual Costs	$6,910,270
Less Average Annual Cost Allocated to Flood Control	5,933,640
Total Average Annual Costs-Inland Navigation	$976,630
Average Annual Benefits[2]	
Inland Navigation	
Delay Reduction Benefits	$15,024,000
Accident Reduction Benefits	1,276,000
TOTAL	$16,300,000
Average Annual Net Benefits	
Total Average Annual Benefits	$16,300,000
Total Average Annual Cost-Inland Navigation	$ 976,630
Average Annual Net Benefits	$15,323,370
Benefit-to-Cost Ratio	
Inland Navigation	16.7: 1

[1]**Based on 2000 price levels**
[2]Based on an interest rate of 5.875 % and a project life of 50 years.